

WHAT IS CLAIMED IS:

1. An image detection apparatus for detecting a target in an input image, comprising:

a database storing at least one target data unit, each of the at least one target data unit including information specifying the target to be detected, used color data representing a plurality of used colors which are used in the target, representative color data representing a representative color selected from the plurality of used colors, and a cluster image representing a positional arrangement of a plurality of areas respectively having the plurality of used colors;

a representative color area extraction section for receiving the input image and information specifying the target to be detected in the input image, specifying a target data unit, from among at least one target data unit stored in the database, which corresponds to the information specifying the target to be detected in the input image, and extracting from the input image, as a representative color area, at least one area having substantially the same color as the representative color represented by the representative color data included in the specified target data unit;

a candidate area extraction section for obtaining at least one candidate area possibly including the target from among the at least one representative color area extracted by the representative color area extraction section, using relative positions of an area having the representative color in the cluster image included in the specified target data unit and a frame of the cluster image; and

a comparison section for comparing the cluster image included in the specified target data unit and each of the at least one candidate area obtained by the candidate area extraction section, and detecting one of the at least one candidate area obtained by the candidate area extraction section based on the comparison result as an area including the target.

2. An image detection apparatus according to claim 1, wherein regarding the at least one representative color area, a product of a similarity and a value of one selected from the group consisting of chroma, luminance, and a product of the chroma and the luminance is larger than a predetermined threshold value, the similarity being obtained from a distance between a hue of each pixel included in the input image and the representative color included in the target data unit, and the chroma and the luminance being of each of the pixels included in the input image.

3. An image detection apparatus according to claim 1, wherein the representative color has a highest chroma among the plurality of used colors.

4. An image detection apparatus according to claim 1, wherein the plurality of used colors are each assigned a color number, the cluster image includes a plurality of pixels, and each of the plurality of pixels included in the cluster image has a pixel value represented by the color number.

5. An image detection apparatus according to claim 1, wherein:

the plurality of used colors include an achromatic

color and a non-achromatic color,

the comparison section detects one of the at least one candidate area as the area possibly including the target based on an inter-image distance between the cluster image and one of the at least one candidate area,

when the number of the non-achromatic colors is larger than a first predetermined value, or the number of areas having the non-achromatic color is larger than a second predetermined value, the inter-image distance is determined independent from an inter-pixel distance between each pixel of an area having the achromatic color in the cluster image and a corresponding pixel in the one candidate area, and

when the number of the non-achromatic colors is equal to or smaller than the first predetermined value, and the number of areas having the non-achromatic color is equal to or smaller than the second predetermined value, the inter-image distance is determined relying on the inter-pixel distance.

6. An image detection apparatus according to claim 1, wherein:

the plurality of used colors include an achromatic color and a non-achromatic color,

the comparison section detects one of the at least one candidate area as the area possibly including the target based on an inter-image distance between the cluster image and one of the at least one candidate area,

when the number of the non-achromatic colors is equal to or smaller than the first predetermined value, and the number of areas having the non-achromatic color is equal to or smaller than the second predetermined value, the inter-image distance is determined based on an inter-pixel distance between each pixel of an area having the achromatic

color in the cluster image and a corresponding pixel in the one candidate area and also based on an inter-pixel distance between each pixel of an area having the non-achromatic color in the cluster image and a corresponding pixel in the one candidate area,

the inter-pixel distance between each pixel of an area having the achromatic color in the cluster image and a corresponding pixel in the one candidate area is obtained based on a luminance normalized by an average luminance of the area having the representative color in the cluster image and a luminance normalized by an average luminance of the representative color area in the one candidate area, and

the inter-pixel distance between each pixel of an area having the non-achromatic color in the cluster image and a corresponding pixel in the one candidate area is obtained based on a hue of each pixel in the cluster image and a hue of each pixel in the one candidate area.

7. An image detection apparatus according to claim 1, wherein:

the candidate area extraction section performs at least one of expansion and reduction of each of the at least one representative color area by a predetermined amount, and obtains a plurality of candidate areas possibly including the target from the at least one representative color area before the expansion or reduction and also obtains a plurality of candidate areas possibly including the target from the at least one representative color area after the expansion or reduction, using relative positions of the area having the representative color area in the cluster image and the frame of the cluster image, and

the comparison section compares each of the plurality of candidate areas obtained in each of the at least

one candidate area with the cluster image, and detects, as an area including the target, a candidate area which corresponds to an inter-image distance, between each of the plurality of candidate areas and the cluster image, which is shortest and is smaller than a predetermined threshold value.

8. An image detection apparatus according to claim 1, further comprising:

a detection area memory section for storing at least two detection areas detected by the comparison section in association with time; and

a processing area specifying section for specifying a processing area in the input image,

wherein the processing area specifying section determines whether or not a positional relationship between the at least two detection areas among the at least two detection areas stored in the detection area memory section fulfills a predetermined condition; when the positional relationship fulfills the predetermined condition, the processing area specifying section specifies the detection section, among the at least two detection sections, which is associated with a latest time and a vicinity thereof as a processing area in the input image; and when the positional relationship does not fulfill the predetermined condition, the processing area specifying section specifies the entire input image as a processing area in the input image.

9. An image detection apparatus according to claim 1, wherein:

the database stores at least one target data set in association with each of at least one environment, and each of the at least one target data set includes at least one

target data unit,

the image detection apparatus further comprises an environment measuring section for measuring parameters of an environment in which the image detection apparatus is located and selecting, from the at least one target data set, a target data set stored in association with the environment in which the image detection apparatus is located, from among the at least one environment, based on the measurement result, and

the representative color extraction section receives the information specifying the target to be detected in the input image, and specifies a target data unit having information corresponding to the information specifying the target to be detected in the input image, from the selected target data set.

10. An image detection apparatus according to claim 9, wherein regarding the at least one representative color area, a product of a similarity and one selected, based on the parameters of the environment measured by the environment measuring section, from the group consisting of chroma, luminance, and a product of the chroma and the luminance is larger than a predetermined threshold value, the similarity being obtained from a distance between a hue of each of pixels included in the input image and the representative color included in the target data unit, and the chroma and the luminance being of each of the pixels included in the input image.

11. A program for allowing a computer to act as an image detection apparatus for detecting a target in an input image, wherein the image detection apparatus includes:

a database storing at least one target data unit,

each of the at least one target data unit including information specifying the target to be detected, used color data representing a plurality of used colors which are used in the target, representative color data representing a representative color selected from the plurality of used colors, and a cluster image representing a positional arrangement of a plurality of areas respectively having the plurality of used colors;

a representative color area extraction section for receiving the input image and information specifying the target to be detected in the input image, specifying a target data unit, from among at least one target data unit stored in the database, which corresponds to the information specifying the target to be detected in the input image, and extracting from the input image, as a representative color area, at least one area having substantially the same color as the representative color represented by the representative color data included in the specified target data unit;

a candidate area extraction section for obtaining at least one candidate area possibly including the target from among the at least one representative color area extracted by the representative color area extraction section, using relative positions of an area having the representative color in the cluster image included in the specified target data unit and a frame of the cluster image; and

a comparison section for comparing the cluster image included in the specified target data unit and each of the at least one candidate area obtained by the candidate area extraction section, and detecting one of the at least one candidate area obtained by the candidate area extraction section based on the comparison result.

12. A computer-readable recording medium storing a program for allowing a computer to act as an image detection apparatus for detecting a target in an input image, wherein the image detection apparatus includes:

a database storing at least one target data unit, each of the at least one target data unit including information specifying the target to be detected, used color data representing a plurality of used colors which are used in the target, representative color data representing a representative color selected from the plurality of used colors, and a cluster image representing a positional arrangement of a plurality of areas respectively having the plurality of used colors;

a representative color area extraction section for receiving the input image and information specifying the target to be detected in the input image, specifying a target data unit, from among at least one target data unit stored in the database, which corresponds to the information specifying the target to be detected in the input image, and extracting from the input image, as a representative color area, at least one area having substantially the same color as the representative color represented by the representative color data included in the specified target data unit;

a candidate area extraction section for obtaining at least one candidate area possibly including the target from among the at least one representative color area extracted by the representative color area extraction section, using relative positions of an area having the representative color in the cluster image included in the specified target data unit and a frame of the cluster image; and



a comparison section for comparing the cluster image included in the specified target data unit and each of the at least one candidate area obtained by the candidate area extraction section, and detecting one of the at least one candidate area obtained by the candidate area extraction section based on the comparison result.